

3.2.6

MEMORANDUM

SUBJECT: Shaffer Landfill - Detailed Gas Emissions Survey

RE: Site Number 3-0240

TO: Dale Young, BWS✓

THRU: Donald Steele, AQSB *lls*FROM: Thomas McGrath, AQSB *gm*

DATE: July 31, 1990

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The following reports the results of the detailed landfill gas emission survey, which was conducted at the Shaffer Landfill (Site Number 3-0240) over two days (July 2 and 16). This survey demonstrated that landfill gas can be measured from and in the vicinity of virtually all manholes (wells) on the landfill and that the gas can also be detected over a number of eroded areas and fissures on the landfill.

BACKGROUND

Earlier this year, odors had been reported in the vicinity of the Shaffer Landfill in Billerica. At the request of the Bureau of Waste Site Cleanup (Boston), the Air Quality Surveillance Branch (DAQS) participated in a site walkover and conducted a preliminary air quality survey on May 23. The primary objective of the survey was to measure methane as an indicator for odor producing landfill gas and to identify the locations some potential sources of gas on the landfill. Several evacuated bottle grab samples were also taken from manholes (gas wells) to identify volatile organic compounds (VOCs) with AAL in the landfill gas.

Although the May survey did show landfill gas emissions from gas wells and eroded areas on the landfill, the walkover was not sufficiently detailed and comprehensive to be used as a basis to direct or evaluate further remedial action. The analysis of grab samples revealed low parts per million concentrations of aromatic compounds (benzene, toluene and xylene) in samples taken directly from the gas wells.

The objective of the July survey was to evaluate the landfill gas emission potential of all wells on the landfill and to identify eroded areas on the landfill which are also sources of gas. Most of landfill was monitored by a survey conducted by Dale Young of the Bureau of Waste Site Cleanup and Thomas McGrath of the Air Quality Surveillance Branch (AQSB) on July 2.

Remaining areas were completed by Tom McGrath and Stephen Spencer

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of the AQSB (Tewksbury) on July 16.

PROCEDURES

A portable flame ionization detector survey instrument (Foxboro Century Organic Vapor Analyzer [OVA]) was used to measure methane during the survey. The instrument was calibrated with a clean air source (for zeroing the instrument) and a mixture containing 95 parts per million (ppm) of methane. A Neutronics Exotox Four Gas analyzer (monitoring the Lower Explosive Limit [LEL] channel) was used to confirm the magnitude of methane concentrations.

An initial measurement with the OVA at the front gate (on Pond Street) was the basis of determining a "Background" level. OVA measurements were taken directly through an opening in each manhole on the landfill and 3-10 feet above and/or downwind (if possible) each manhole cover. Percent LEL measurements were taken through a probe which was inserted into openings in most manholes.

Evacuated bottle grab samples were taken directly over (0.5-1 foot above ground) four eroded landfill areas where elevated OVA levels were measured. Grab samples were analyzed using an HNU Systems gas chromatograph (equipped with photoionization and electron capture detectors in series) in the Mobile Air Monitoring Laboratory in Tewksbury.

The landfill was systemically surveyed starting at the Pond Street gate, proceeding from well to well on the near mound (Attachment A where wells are labelled with the prefix A) to the far mound (Attachment B where wells are labelled with the prefix B). Erosion areas on each mound were also investigated and assessed. Most wells and areas were investigated during the July 2 survey. However, nine wells on Mound B were assessed on July 16.

The weather on both days was clear and warm. Although the wind at ground level was affected by the terrain on the landfill, the direction appeared to be from the northwest at approximately 0 to 15 miles per hour on July 2 and from the southwest at about 0 to 15 mph on July 16.

RESULTS

Organic Vapor Analyzer (OVA) measurement results are presented in parts per million (ppm) units. Although the instrument is calibrated with a standard parts per million methane mixture and the landfill gas is predominantly methane, the gas from each area is an organic mixture of unknown composition and presented results are for comparison and relative evaluation only and are not meant to determine absolute values for any gas.

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All landfill wells are listed in Table 1 and are represented on the landfill map (Attachments A and B). OVA readings taken with the probe inserted through openings in or around the landfill covers exceeded the measurement range of the OVA (greater than 1000 ppm as methane), except for Well B-12 which registered 10 ppm. LEL readings ranged from 1 $\frac{1}{2}$ LEL to "Off Scale". These results are not listed because they are considered to be qualitative and the measurements on site were found to be affected by low oxygen levels in the wells. Also, high "Off Scale" levels appeared to lower the instrument's sensitivity for subsequent measurements. However, readings from at least 7 wells (A-1, A-13, A-5, A-15, B-1, B-8 and B-20) exceeded 100% Lower Explosive Limit.

Table 1 presents the results from OVA measurements taken in the vicinity of gas wells. The location of each well is designated on the site maps (Attachments A and B). These measurements were taken 3 to 10 feet above and downwind of the manholes. Differences in the condition of the manhole covers and wind speed (odors and OVA readings tended to be greater immediately downwind when the wind speed was high) contributed to the range of values measured. Recorded values were averages measured while a reading was taken. Values fluctuated considerably before the recorded range or value was established.

Table 2 presents the results from OVA measurements taken at locations other than the wells. Locations corresponding to the ID numbers listed on Table 2 are marked on Attachments A and B (the site maps). Although most of the readings were taken directly above eroded areas of the landfill and at ambient locations downwind of wells and other gas sources, three "source" readings are included. These readings (at locations 6, 46 and 48) were taken from two pipes and one hole in the surface. The entrance fence line reading of 6 ppm (location 1) represents the "background" concentration, which can be subtracted (but was not in this report) from upscale reading, taken on the landfill. The OVA is zeroed slightly upscale to allow the prevention of negative readings (due to instrument drift) and to detect the extinguishment of the flame (which can easily be caused by high offscale readings).

Below are the results of the analysis of four (4) evacuated grab samples taken over eroded areas on the landfill. Sampling locations are identified in Table 2. Three samples were taken at locations on Mound A and one sample was taken at a location on Mound B. Toluene was the only volatile organic compound identified in the samples.

ID	Location	Parts Per Million
	Toluene	
3	Erosion Area near Well A-10 (Mound A)	0.281
5	Erosion Area above MW-G1 (Mound A)	0.085
17	Erosion Area near Well A-12 (Mound A)	0.043
32	Erosion Area near Well B-8 (Mound B)	0.031

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DISCUSSION

The limitations of the monitoring instrumentation (the Organic Vapor Analyzer) and the nature the source under study (the landfill) preclude the production of standard comparable gas emissions data by a study such as this one. The main objectives of this study was to comprehensively identify the sources of gas on the landfill, to evaluate the condition of the gas collection system (through direct gas well measurements) and to measure the relative strength and characteristics of these gas sources.

The findings of this study include the following:

1. Gas was found to be leaking from all the wells. Offscale (greater than 1000 ppm) readings were recorded when the OVA probe was inserted under the cover of all wells except one. The consistency of these readings leads me to believe that the exception was caused by a measurement error or by a condition unique to the one well (B-12).
2. Ambient gas measurements taken in the vicinity of wells showed a wide range of concentrations. The levels of gas detected in the ambient air over the wells appeared to depend on the condition of the wells and the covers and by the wind speed blowing across the well. High wind seemed to yield higher concentrations than calm when monitoring was conducted under these conditions.
3. Gas and odor levels appeared to be consistently higher in the vicinity of eroded areas than near gas wells. Although ambient measurements taken in the vicinity of gas wells fluctuated considerably, upscale levels detected near and over eroded areas of the landfill stayed high. The writer observes that an eroded area on Mound B near Well B-22, where OVA readings were consistently over 100 parts per million, seemed to be the best example.
4. Openings in the ground appear to be conduits for gas. Offscale readings were observed in the mouths of pipes and holes in the surface.
5. The landfill gas does contain some aromatic hydrocarbons (benzene, toluene and xylene). Grab samples from the May study, taken directly from gas wells, were found to have benzene, toluene and xylene in a range from 100 parts per billion to 11 parts per million. Grab samples taken on July 2 over eroded areas of the landfill, where upscale OVA measurements were recorded, only identified toluene from 31 - 281 parts per billion.

Concentrations of aromatic compounds similar to those found in samples taken this year, were found by a study conducted January 30, 1990 (see MEMO dated June 4, 1990). Four hour time weighted tenax samples, taken at 4 locations on the landfill

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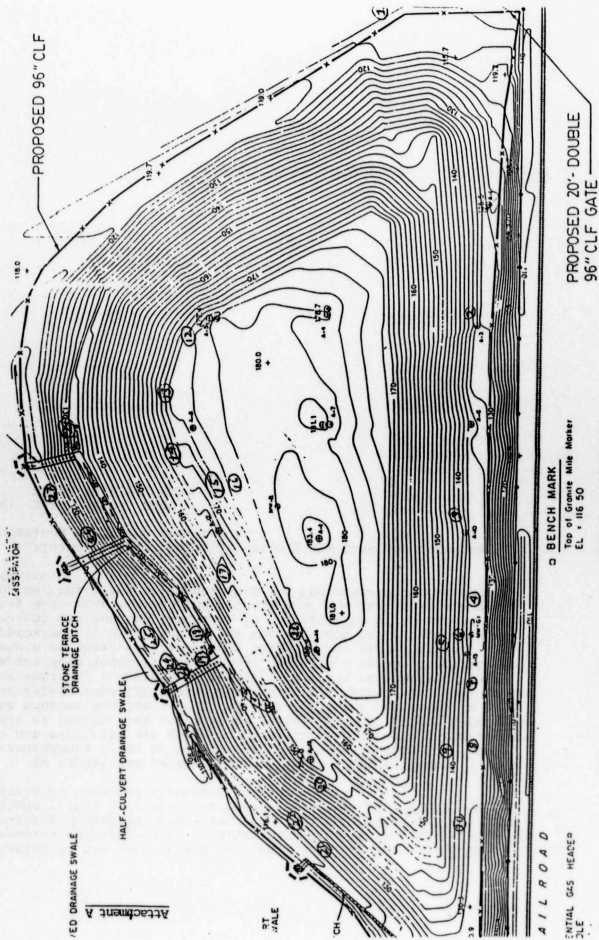
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(including the gate as a background site) on January 30, 1990 revealed concentrations of aromatic compounds slightly higher (Maximum Concentrations - Benzene = 3.1 ppb; Toluene = 9.6 ppb; Xylene = 10.7 ppb) than the background site and typical ambient levels as measured elsewhere in Massachusetts.

As emphasized in the previous text, concentration measurements taken by continuous instruments during this study, do not represent air quality data which can be used directly for odor or health risk assessments. Also, because of the natures of the sources and the survey, measurements were not taken in a completely repeatably standard manner and therefore, readings are not entirely comparable. However, the data presented by this report does identify gas (and odor) sources on the landfill, the nature of their emissions (gas wells versus eroded areas), the approximately magnitude of the emissions and their impact on the ambient air (on the landfill) in the vicinity of these sources. They also characterize the mechanism of the landfill as a gas source, which may be responsible for the observation of odors offsite.

Please contact the writer should you have any comments or questions regarding this report.

cc: Sarah Simon, DAQC
Helen Waldorf, BWSC



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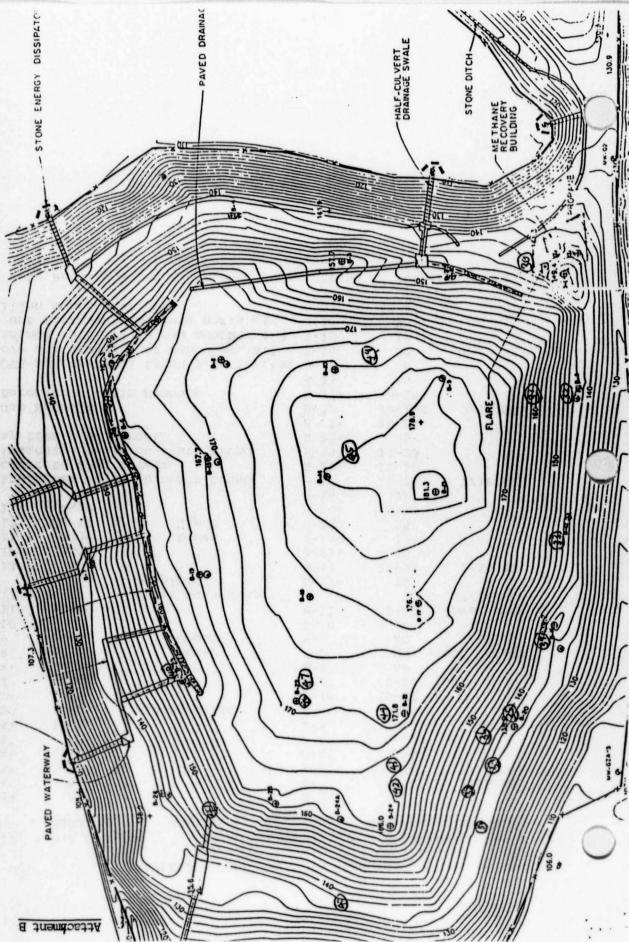
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TABLE 1 - Gas Well OVA Readings

Well ID	* OVA Ambient Reading	Comment	Well ID	* OVA Ambient Reading	Comment
A-1+	30		B-1+	25	
A-1~	15		B-2	18-20	7/16/90
A-3+	30		B-3	30-40	7/16/90
A-4+	8-10		B-4+	40-700	
A-4~	8		B-4~	20-100	
A-5+	10-12		B-5	15-100	7/16/90
A-5~	NR	>1000 Inside	B-6	Bkgd	
A-7+	10		B-7+	15-20	
A-7~	Bkgd		B-7~	30-50	
A-8+	20-30		B-8+	60	
A-9	10-20	Lower	B-8~	NR	>1000 Inside
A-9	10-20	Upper	B-9	20	7/16/90
A-10	15		B-10	90	
A-11+	8-10		B-11	30-60	Cover Off
A-12	10	Cover pushed up by piping			7/16/90
A-13+	10		B-12+	10	
A-14+	Bkgd		B-13	30-50	7/16/90
A-15	Bkgd	Lower	B-14+	60	
A-15	30-40	Upper	B-15+	10	
A-17+	Bkgd		B-15~	25	
			B-16+	20-30	
			B-16~	30	
			B-17	15-30	7/16/90
			B-19+	10-20	
			B-19~	10-20	
			B-20+	25	
			B-21+	30-90	
			B-22	30-100	7/16/90
			B-23+	10-20	
			B-23~	10	
			B-24+	30	
			B-24~	20	
			B-25	10	
			B-26+	NR	
			B-26~	30-40	

A indicates wells on north mound closest to Pond Street.

B indicates wells on south mound away from Pond Street.

+ Gas Manhole

~ Barometric Drain Manhole

* OVA measurements taken 3 to 10 feet above and downwind of manholes. All readings relative to one another and do not represent absolute parts per million concentrations.

NR = No Reading Taken

Bkgd = Background as measured at entrance fenceline.

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TABLE 2 - OVA Readings (Erosion Areas)

MEASUREMENT LOCATIONS (A MOUND)

ID	* OVA Ambient Reading	Comment
1	6	Background at Entrance
2	Bkgd	Erosion Area Near A-3
3	20-60	Erosion Area Near A-10
		Grab Sample A location
4	20	Access Road
5	50-60	Erosion above MW-G1
		Grab Sample B location
6	>1000	Pipe near MW-G1
7	10-20	Access Road
8	50	Access Road Puddle
9	40-100	Eroded Area
10	Bkgd	Not Eroded
11	20-30	Eroded Area
12	20	Eroded Area
13	20-50	Eroded Area
14	20-30	Eroded Area
15	> 100	Access Road
16	20	Eroded Area
17	30-40	Eroded Area
		Grab Sample C Location
18	20-50	Outbreak Near A-15
19	30-70	Downwind of A-15
20	Bkgd	Dead Vegetation
21	50	Eroded Area
22	20-30	Eroded Area
23	10-20	Access Road
24	60	Eroded Area
25	20-30	Access Road
26	20-55	Eroded Area
27	15-70	Eroded Area
28	20-50	Eroded Area
29	10	Eroded Area
30	20	

MEASUREMENT LOCATIONS (B MOUND)

ID	* OVA Ambient Reading	Comment
31	10-20	Eroded Area
32	50-100	Eroded Area
		Grab Sample D
33	20-30	Eroded Area
34	20-30	Near B-16
35	30	
36	30-50	Eroded Area
37	150-300	Eroded Area;
		Access Road
38	10-20	Eroded Area
39	20-100	Eroded Area
40	20	
41	50	
42	37	
43	30-50	Eroded Area
44	> 100	
45	90	
46	>1000	Hole in Ground
47	> 100	Constant
		Readings
48	500	PVC pipe
		near B-23a
49	30-40	Eroded Area

* OVA measurements taken 2 to 6 feet above ground. All readings relative to one another and do not represent absolute parts per million concentrations.

Bkgd = Background as measured at entrance fenceline.